

of the uses of this deflector, which is an important point to those desirous of using the instrument.

In four chapters of his *Practical Guide* M. Collet has given, in detail, practical rules for correcting the errors of the compass without bearings, illustrated by numerous examples, and including instructions for the graduation of the deflector, or measuring the magnetic force for each division of its scale. Collected in a tabular form, the results of this graduation will be found of great use to observers, and of the five advantages arising from it enumerated by the author, not least is that which gives an approximate value of the coefficients of deviation. This would prove useful when the observer, wishing to leave the magnets undisturbed, required only to know if any change of deviation had taken place.

Another advantage of this graduation is that it forms an additional method of measuring the diminution of the mean directive force of the compass on board ship as compared with that on land, or the term λ of the text-book. λ is a necessary element in the exact correction of the heeling error—a part of the correction to which the author devotes a chapter, as it rightly comes under the denomination of a compensation requiring no bearings.

Lieut. Collet, in his introductory chapter and elsewhere, strongly urges that the deflector, concerning the uses of which he has written so fully, should in the immediate future become the chief instrument used in the compensation of compasses, on account of the rapidity and sufficiency of precision with which it may be made, and that it be adopted for frequent if not daily use on board ships at sea. Before remarking on this proposal it may be as well to inquire into the present customs with regard to the standard or navigating compass at the time of its first compensation and subsequent changes of deviation.

In the Royal Navy the adjustment of compasses is invariably made by bearings, and the instances are rare when the adjustments of the standard compass alone, including the final swinging of the ship, occupy more than an hour or two with results absolutely correct. Subsequently to this one adjustment the compensating magnets are not moved during their three or four years' period of service, but the deviations of the compass are carefully observed on all occasions when bearings can be taken—in other words, from day to day—and noted for guidance when bearings cannot be taken. In the Mercantile Marine a large number of ships are fitted with Sir W. Thomson's standard compass with the accompanying magnets adjustable at pleasure. This compass is often compensated by experts in the use of the deflector and the magnets left in a given position.

Now, what is the almost universal practice of the commanders of these vessels subsequent to this adjustment by means of the deflector? They observe the deviation frequently by day and night when possible, note the results in a compass journal for present and future guidance, and object most strongly to any alteration of the magnets.

In the paragraph headed "Weather" it will be seen that a moderately smooth sea is required when using the deflector, and in another place it will be seen that it is no certain guide to navigation unless observations are made on all the cardinal points. The question therefore arises, Are the necessary conditions for using this instrument

often available in the North Atlantic and "roaring forties," when bearings are at times unobtainable for some days?

The result of the foregoing consideration is to show that there is long custom of very practical men—and possibly prejudice—to overcome before Lieut. Collet's future of frequent use of compensation without bearings becomes general.

The nautical world has had the deflector as invented by Sir W. Thomson before it for some years; it now has an excellent practical guide to its use in the book under review, and it remains to be seen how far that world will avail itself of the invention.

It may probably suggest itself to some minds that the book would lose none of its value by being shortened somewhat in detail; indeed, the shorter the better, if combined with accuracy for the practical navigator, and should a new edition be required the translator who has done his part well, and knows the deflector thoroughly, will perhaps try his hand at the work of condensation.

THE FORBES MEMORIAL VOLUME

In Memoriam. The collected Scientific Papers of the late William Alexander Forbes, M.A., Fellow of St. John's College, Cambridge, Lecturer on Comparative Anatomy at Charing Cross Hospital, Prosector to the Zoological Society of London. Edited by F. E. Beddard, M.A., Prosector to the Zoological Society of London. With a preface by P. L. Sclater, M.A., Ph.D., F.R.S., Secretary to the Zoological Society of London. (London: R. H. Porter, 1885.)

THE death of Alfred Henry Garrod at the early age of thirty-three was a great misfortune to the cause of zoology in this country. But that his distinguished successor, William Alexander Forbes, a man full of vigour and in the best of health, should have suddenly succumbed to the influence of a pernicious climate at the age of twenty-eight, was perhaps a still more severe blow, and one that will long be felt by the naturalists of the present day. We do not seek to compare Forbes with Garrod, but it must be recollected that Forbes was a man of undoubtedly strong physique, for whom there was every prospect of a long and successful career. There can be not the slightest doubt that, had he not lost his life from the accidental force of circumstances, Forbes would have left a considerable mark on the progress of science. As regards natural history at least, if not in some other matters, Forbes was a universal genius. Of the whole zoological series he had an enormous knowledge, ranging from one end of the animal kingdom to the other. Possessed of a most retentive memory and of an abundant stock of energy, he was unremittingly at work on his favourite subject, and never forgot what he had acquired either by reading or by experience. Not only was he thoroughly up in zoological literature, but he was also an accurate observer and a diligent collector in the field, where nothing came amiss to him. Mammals, birds, butterflies, and beetles were perhaps the groups which he knew best; but Forbes had, as already stated, an excellent general knowledge of the whole animal series. Whatever novel object might be shown to him he was very rarely at a loss for its

correct name, nor for where to refer to for information about it.

It can thus be well understood, even by those who never had the good fortune to know Forbes, that the loss of such a man was keenly felt by his numerous friends and fellow-workers. Soon after his death, in 1883, it was resolved, at a meeting of the Zoological Club, that some sort of memorial of him should be carried out. After due consideration of the question it was unanimously determined by the Committee to whom the subject was referred that the best scheme would be the republication of Forbes's numerous papers in a connected form. This had been the course adopted in the case of Garrod, who had preceded Forbes in the Prosectorship of the Zoological Society of London. It was found that Forbes's contributions to science would make a volume of about the same size as the scientific papers of Garrod, and would not, it was believed, be of inferior interest.

The memorial volume, prepared and issued under these circumstances, contains sixty-seven papers published by Forbes in different periodicals from 1875 to 1882. The original illustrations have been in every case reproduced, and to increase the usefulness of the reprint, exact references to the paging of the original articles are added in the margin. At the end of the volume is given Forbes' last journal, reprinted from the *Ibis* for 1883, and containing a most interesting account of his observations during his fatal expedition up the Niger. Forbes died at Shonga, one of the stations of the United African Company on that malarious river, on January 14, 1883. Up to two days before his death the entries in the journal are in his own writing. The fatal termination of his illness, recorded by another hand, concludes the volume.

OUR BOOK SHELF

Elementary Algebra for Schools. By H. S. Hall, B.A., and S. R. Knight, B.A. (Macmillan, 1885.)

THIS is, in our opinion, the best *elementary* Algebra for school use. It is the combined work of two teachers who have had considerable experience of actual school teaching, aided by the advice of such men as the present Head of Clifton College, and so successfully grapples with difficulties which our present text-books in use, from their authors lacking such experience, ignore or slightly touch upon. Up to the point to which the subject is carried in this volume, it is treated with sufficient completeness for ordinary school purposes: the last four chapters present a somewhat concise account of ratio, proportion, and the progressions, which, however, covers enough ground for the ordinary examinations which schoolboys have to encounter. The authors propose to treat these parts in fuller detail in a *Higher Algebra*, which they are preparing. We do not propose to examine the book at any length, but confidently recommend it to mathematical teachers, who, we feel sure, will find it the best book of its kind for teaching purposes. Many subjects of interest are also treated of, and a vast collection of (3500) examples will furnish ample exercise for the boys, and save the teacher the trouble of concocting illustrations of the best methods. Answers are furnished at the end, so that those teachers who do not care that their pupils should have them handy, may have them sewn up.

Key to the Elements of Euclid. By J. S. Mackay, M.A. (W. and R. Chambers, 1885.)

THIS is a most valuable pendant to the edition of the "Elements" which we recently had occasion to notice so

favourably. It is a book of nearly the same size as the "Elements" and yet contains, in consequence of the general omission of diagrams, solutions of the very large collection of admirable deductions which Mr. Mackay collected for the student in that work. De Morgan's words, quoted in the short preface, furnish ample ground for the omission of figures: "I am satisfied, from sufficient trial, that when proper description of the diagram is given in the text, the person who draws his own diagram from the text will arrive at the author's meaning in half the time which is employed by another to whom the successive appearance of the parts is prevented by his seeing the whole from the beginning."

The Essentials of Histology. By E. A. Schäfer. (London: Longmans, Green and Co., 1885.)

THIS will prove a useful book for students. It is arranged in forty-two lessons and appendix. Each lesson commences with a short statement of methods for the microscopic examination of the tissue described in the lesson. All simple tissues and organs are thus passed in review, and their most essential characters are succinctly described and illustrated. It is to be regretted that Prof. Schäfer has deviated from the customary plan of giving some kind of reference both for the text and the illustrations. The latter are mostly taken from Prof. Schäfer's portion of Quain's Anatomy, and their original source, although mentioned in Quain's, is here omitted.

An index at the end of the book would be a desirable addition.

E. KLEIN

An Atlas of Practical Elementary Biology. By G. B. Howes. (London: Macmillan, 1885.)

THE anatomical drawings of Mr. Howes have for some years been well known in all laboratories where animal morphology is taught. In his "Atlas of Elementary Biology" he has now published a very complete series of figures illustrating the chief of those animal and vegetable types which are generally given to students in their first session. The need for such a work as this is well known to every one who has any experience of biological teaching; and the name of its author is a sufficient guarantee of the careful accuracy and artistic excellence of the drawings it contains. The low price at which a student's text-book must necessarily be sold has precluded the use of colour, which might in a few cases have given some additional clearness to the figures; but all that could be done with black and white has been done, and every figure is evidently a faithful copy of an actual dissection, such as a student may reasonably hope to repeat for himself.

In the case of every animal chosen, a series of drawings showing the gross anatomy of the adult is followed by a few illustrations of the minute structure of its tissues, and of its main developmental features.

The drawings of adult anatomy are throughout excellent; the others, though the size of the work has somewhat restricted their number, will probably suffice for most of the needs of commencing students. It is however to be regretted that there is no figure showing the minute structure of the gill in *Anodon*, and also that Mr. Howes has not been able to accept Spencer's statement as to the conversion of the frog's blastopore into the permanent anus.

The botanical portion of the Atlas contains an admirable series of figures, showing the structure of the plants described in Huxley and Martin's well-known text-book, and completes a work which cannot fail to be of the greatest service both to teachers and to students of biology.

W. F. R. W.